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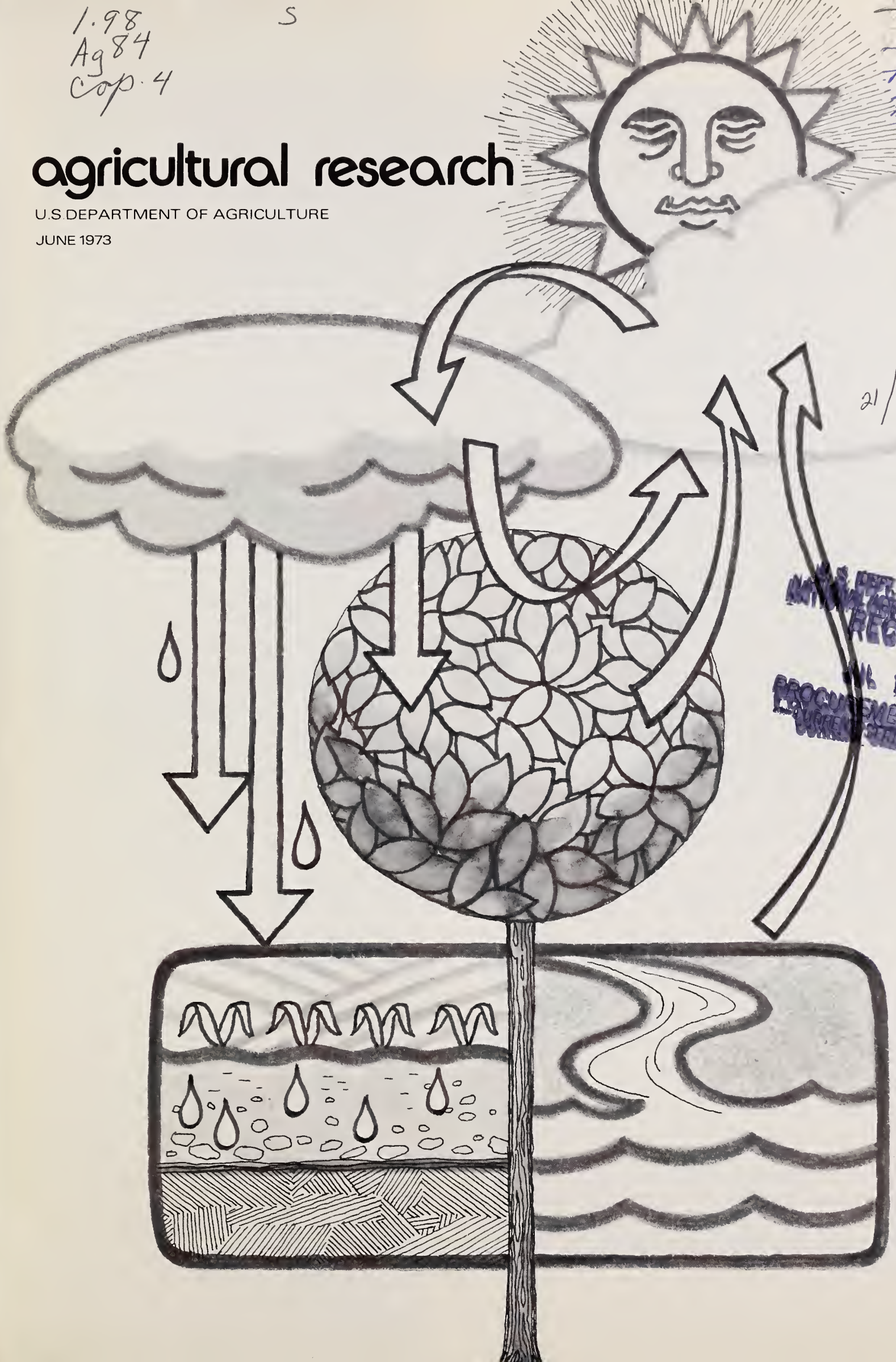

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Foster Mother

Man and the cow have come through the ages together. So enduring is she in our human heritage that even in this urban era the word *cow* often evokes idyllic images of winding streams, tree-dotted meadows, and sleek herds heading homeward, nourishment evident in full and swinging udders. It is not without reason that generations of writers have extolled the cow as the foster mother of mankind. For she is an alchemist, transforming forage and feedstuffs into milk—nature's most nearly perfect food. From early agrarian times milk has held a key place in the Western human dietary as a protective food, one supplying ample amounts of such nutrients as calcium, phosphorus, riboflavin, and protein.

Ironically, the primitive cow secreted barely enough milk to suckle her young. Today's dairy cow, shaped by agricultural science, frequently yields 20,000 pounds of milk in 10 months; the record producer has topped 44,000 pounds. In the total picture, 12.7 million cows now produce as much milk as 18 million did 15 years ago. This achievement stems largely from advances in dairy herd testing, sire evaluation, and artificial breeding. Taken together, these tools provide the dairyman a wealth of information about individual cows so that he can feed more efficiently, cull low producers, and breed to bulls of superior genetic transmitting ability. Indeed, the genetic improvement of dairy cows far outstrips that of any other class of livestock.

Despite the cow's prodigious output, her product has dropped in popularity in recent decades, to the great concern of nutrition authorities. Hopefully, this decline may have been arrested for per capita milk consumption marked an upturn last year. Even so, the cow is inextricably a part of the affairs of men. Dairy husbandry, for example, with its reliance on pastures and home-grown feedstuffs serves to preserve the soil. More than any other farm animal the dairy cow affords the best avenue for marketing our vast forage resource. Presently some 60 percent of her ration consists of forages; she could do justice to more with improvements in forage production, traditionally the orphan of the American agricultural scene. Many people are unaware that the dairy cow accounts for 18 percent of the U.S. beef supply, through her calves and her own salvage when her milking days are over.

The cow has come a long way since her early associations with man. Aided by agricultural science, the dairy cow will meet the changes and challenges of tomorrow.

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COVER: Ground water reservoirs are an integral part of the water cycle, and scientists may have found a way to keep this water source from becoming turbid. See story on page 6.

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U.S. Department of Agriculture

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Agricultural Research Service

Mrs. Wondolowski takes a sample of milk that has been run through a column of immobilized enzymes to hydrolyze the milk lactose (BN–40098).

Milk products for the lactose-intolerant

For most Americans, milk is an almost perfect food. Its digestion is difficult for some, however, because of their low tolerance for the milk sugar, lactose.

ARS scientists are working to develop special dairy products in which most of the lactose is predigested. Such products could be consumed in unlimited quantities, even by people with severe lactose intolerance.

Worldwide, lactose intolerance is common. Many blacks and people of oriental descent are affected by it. It is far less prevalent among caucasians.

The reasons for these racial differerences are not well understood, but the mechanism of lactose intolerance is known. It arises from deficiency in the intestines of an enzyme called lactase. Lactose is not utilized by the body unless lactase first hydrolyzes it—that is, breaks it down—into its two simple sugars, glucose and galactose.

The lactase-deficient can suffer abdominal pain, flatulence, bloating, or diarrhea if the capacity of their system for lactose utilization is exceeded.

Since most of the world's population, and in particular millions of its hungry and malnourished, have varying degrees of lactase deficiency, the problem must be reckoned with. The answer is not, according to the United Nations Protein Advisory Group, to eliminate milk as a protein source in large-scale feeding programs for the malnourished. The benefits of milk's high-quality protein are too great to justify such restriction. Instead, these experts recommend development of low-lactose dairy foods to provide protein where normal dairy products are not readily digestible because of lactase deficiency or other gastrointestinal malfunctions.

At the ARS Eastern regional research laboratory, Philadelphia, dairy products are being treated with lactases from molds and bacteria. These enzymes hydrolyze lactose, but they work effectively only under acidic conditions, which cause fluid milk to coagulate.

One of these lactases, however, from the mold *Aspergillus niger*, was used successfully to treat cottage cheese whey. Unlike most wheys and other dairy products, which are neutral in pH, cottage cheese whey is highly acid. Hence this mold lactase treats it readily. Because the enzyme is rather expensive for use on a low-cost product like whey, chemists John H. Woychik and Valerie Wondolowski chemically bound the lactase to porous glass beads and then pumped the liquid whey through the column, using the same lactase again and again.

In other work, at the ARS Western regional research laboratory in Berkeley, Calif., scientists working on applications for various bound enzymes, developed another method for converting lactose in whey. Chemists Alfred C. Olson and William L. Stanley found a way to absorb lactase to a granular phenol formaldehyde resin, then bind it to the resin with another chemical, glutaraldehyde.

More recently, yeast lactases have become available that are highly promising for dairy products. Yeast enzymes operate near the neutral pH range, but the conventional ones affect flavor. Dr. Woychik observed that these new yeast lactases effectively split the lactose of whole and skim milk into glucose and galactose without causing off-flavors. The only flavor effect was the increase in sweetness that always results because the simple sugars have a sweeteer taste than lactose.

The new yeast lactases have also been used at the ARS Dairy Products Laboratory in Washington, D.C., to make low-lactose fluid, concentrated, and powdered milks, and whey-containing ice cream. The enzymes were simply added to these products in pilot-plant processes developed by food technologist Eugene J. Guy and chemists Arjen Tamsma, Floyd E. Kurtz, and Michael J. Pallansch.

All these products had 90 percent or more of their lactose hydrolyzed. Their flavor was unchanged, except for the added sweetness. This would be an advantage, permitting sweetened and flavored milk drinks to be made with less added sugar, hence less calories. For some applications, in fact, splitting lactose with enzymes may be valued for the sweetening effect alone.

Substantial quantities of the enzyme-treated products have been made in the Dairy Products Laboratory pilot plant. Industrial firms that have received samples have expressed interest in them.

Meanwhile, the search goes on for additional lactase sources. Microbiologist Leroy C. Blankenship, of the Dairy Food Nutrition Laboratory at Beltsville, Md., is screening microorganisms for lactase activity. Of 350 species he has examined so far, about 10 look promising for further study. It may well be that the lactase produced by one or more of these will eventually be found useful for splitting the lactose in dairy products.

If lactase treatment with enzymes can be translated to a practical commercial operation, nutritious dairy foods and drinks may play an even larger part in relieving hunger at home and abroad. □

Americans are eating more sugar *

AMERICANS are eating more sugar than at any time since early this century, they are eating more of it in refined form, and they are getting much of it in ways that are not immediately obvious to them.

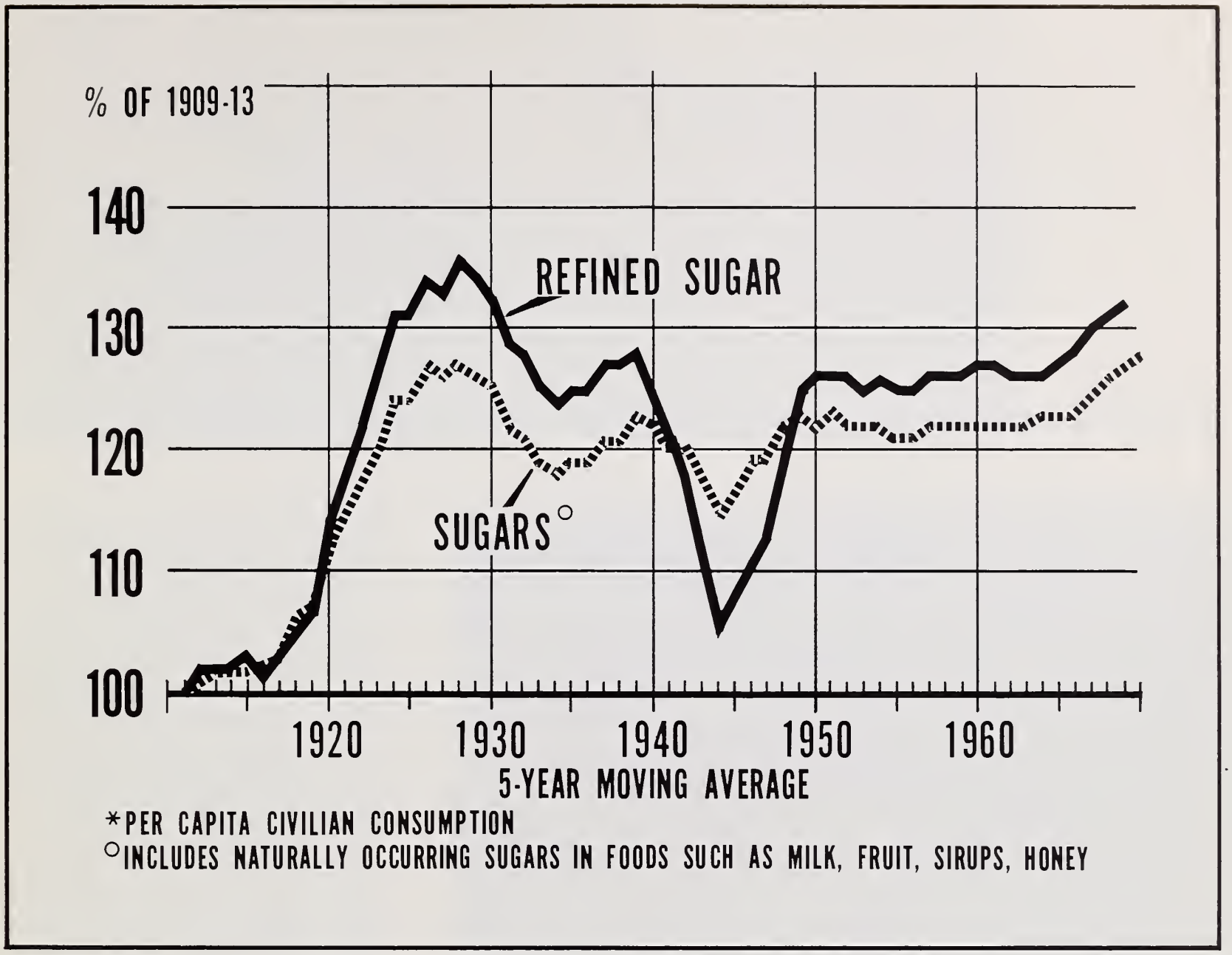
The total sugar content of the U.S. diet—that is, sugar from all sources, including the naturally occurring sugar found in many foods as well as that in sirups, honey, beets, and cane—has gone up about 25 percent since the early 1900's.

Most of the increase has resulted from greater use of refined sugar in prepared foods and beverages *before* they get into the home. In effect, today's consumers seem to have less control over the sugar content of their diets than people did some 60 or 70 years ago.

These are some of the conclusions drawn from a study on the level of use of sugars in the United States, conducted by scientists of the ARS Consumer and Food Economics Institute, Hyattsville, Md. Nutritionist Louise Page and food economist Berta Friend used food consumption statistics provided by USDA's Economic Research Service in arriving at estimates on the kinds and amounts of sugars present in the national food supply.

The scientists point out that while such data cannot tell us what people actually eat, they can give us a good picture of average per-capita consumption at any one time. Moreover, such data can be useful for following trends in consumption over a period of years, and permit an accounting of most of the refined sugar and other sweeteners in prepared convenience-type foods.

The study reveals that per-capita use of refined sugar—from beets and



cane—has gone up 33 percent since the beginning of the century. Americans are now consuming about 102 pounds of refined sugar per person a year, or about 130 grams per day. More than two-thirds of that amount comes from the various food products and beverages that are commercially prepared outside the home. Beverages alone, primarily soft drinks, comprise the largest single use of refined sugar, accounting for over one-fifth of the total refined sugar in the U.S. diet.

Interestingly, another time when use of refined sugar in American diets reached a high level was in the late 1920's. During prohibition, a large part of the sugar may have been used in making illegal alcoholic beverages.

Scientists suggest that several developments in addition to greater use of prepared foods and beverages outside the home have contributed to the present increased use of refined sugar. These include higher income, which increases the demand for food and food-containing products; higher proportion of teens and subteens in the population who are likely to drink above-average quantities of soft drinks; development of new uses for sugar; and withdrawal of cyclamates from the market in 1970 and their partial replacement by sugar.

For comparison, Dr. Page and Miss Friend reviewed the national trends in consumption of total carbohydrates (including sugar), protein, fat, and food energy as measured in calories.

The total carbohydrates provided by the U.S. food supply have declined by about 25 percent since early in this century, attributable to the fact that people are using less flour and eating fewer cereal products. The calorie level has dropped only about 5 to 10 percent since the early 1900's and is currently about 5 percent lower—averaging about 3,300 calories per person per day. A slight upward trend in calories was noted the past few years. This trend reflects the increases in levels for protein and fat. Protein is now near the record levels reported in the early 1900's, around 100 grams per day. Fat also is at its peak, having increased about one-fourth over the past six decades, to a level of approximately 155 grams per day. □

Below: *A 1-acre ground water recharge basin at the ARS Southwestern Great Plains Research Center, Bushland, Tex. The basin has been dug through dense top layers of soil to more porous layers below so water can seep down to replenish the water table (0872W1124–29).* ***Right:*** *Dr. Stewart examines sediment deposits beside a recharge basin. Basins dug into porous soil seem promising, but they eventually become clogged with this clay sediment. If the basin is drained and dries out, the sediment curls and cracks as it has here, and can easily be scraped off. The basin will then once again be suitable for recharge (0872W1102–12).*

Recharging ground water reservoirs

SHALLOW BASINS may be a feasible way to recharge ground water reservoirs with turbid water.

Investigations at the ARS Southwestern Great Plains Research Center, Bushland, Tex., show that more than 35 percent of the sediment suspended in recharge water remains on the surface of the basin floor, and that more than 90 percent of the sediment is filtered in the top 1 inch of the basin floor.

By utilizing cesium-134 radiotracer techniques, researchers followed the sediment in a 0.1-acre experimental basin. Measurements of small amounts of sediment movement can be made very accurately by radiotracer techniques.

Experiments on cesium sorption showed that microquantities of cesium are readily fixed by clay and are essentially nonexchangeable. And, because of the calcium in the soils of the Bushland region, it was important that calcium did not compete strongly with small amounts of cesium in adsorption.

The recharge basin was constructed by removing the slowly permeable surface of the Pullman clay loam. The basin floor was then cultivated to break up the naturally occurring large soil pores. This procedure would prevent sediment from running deep into the soil. Too much sediment would shorten the useful life of the basin.

When openings of naturally occurring large pores were allowed to remain at the basin surface, 50 percent of the sediment suspended in the recharge water was moved deeper than 15 inches. However, when large pore openings at the surface were destroyed by cultivation, more than 90 percent of the suspended sediment was filtered in the upper 1 inch of the basin floor.

Scientists found that sediment which accumulates on the surface of the basin floor tends to plug the surface during recharge, but, they point out, the thin coating can be removed easily and inexpensively between recharge cycles.

The small amount of sediment that moved deeper than the top 1 inch of soil did not appreciably reduce the infiltration rate after seven cycles of recharge with turbid water. Less than 3 percent of the sediment went beyond 6 inches deep and no Cs-134 tagged sediment was found below 30 inches.

Total water recharged during the experiment was 52.20 cubic feet per square foot of basin floor. The water contained 0.54 pound of sediment per square foot of basin floor.

The research was conducted by soil scientists Don W. Goss, Samuel J. Smith, Bobby A. Stewart, and Ordie R. Jones, Bushland, Tex. □

In research aimed at artificially recharging ground water in the vast agricultural Southern Great Plains, Dr. Stewart and technician Robert Toland check the rate at which water is seeping from a recharge basin into the water-bearing formation below (0872W1114–29).

Keeping cotton wastes fro

AIR POLLUTION resulting from the handling and processing of cotton has long been a monkey on the backs of cotton ginners and the surrounding communities. Without adequate collection measures, the pneumatic systems of a high-capacity cotton gin can release thousands of cubic feet per minute of air containing trash, lint, and dust into the environment.

At the ARS Cotton Ginning Research Laboratory, Stoneville, Miss., engineers Oliver L. McCaskill and Richard A. Wesley have modified a commercially available filter to collect all types of trash from all the air systems in the cotton gin.

The improved filter shows promise of being a better overall collector of cotton waste, and possibly cheaper than present collection systems. The experimental unit operates at 99-plus percent efficiency. Moreover, the dust concentration in the discharge air of the experimental filter is comparable to, or less than, that emitted from presently used cyclone and inline filters. Thus, the experimental unit may play an important part in controlling air pollution from cotton gins.

The experimental unit consists of an impinging baffle, a settling chamber, and a filter drum. The filter drum is 5 ft. in diameter, 10 ft. long, and has a filter area of about 120 square ft. of polyurethane foam.

Heavy trash that enters the filtering system strikes a baffle which deflects it downward into the trash hopper, thus protecting the filtering media from damage. A material-handling fan removes the heavy trash from the hopper and delivers it to a trash house. Lightweight material remains entrained in the air to be trapped by the polyurethane foam filter. This material is then doffed (removed) from the filtering media by pressure-actuated vacuum nozzles.

The modern cotton gin in the Mississippi Delta area has an average processing capacity of 12–15 bales per hour. Machine picked cotton contains from 100 to 150 pounds of trash per bale. This, then, subjects the material handling system of the cotton gin to approximately 1,200 to 2,250 pounds of gin waste per hour. What happens to this gin waste? Is disposal a boon or a bother? Perhaps both.

While incineration is the simplest means of disposal, most incinerators do not meet the requirements of air quality control boards. In semiarid areas the cotton waste is transferred to the field and used as compost to assist in holding soil moisture. However, if verticillian wilt disease is present it can be spread from field to field by this method of disposal. Another method of disposal is to turn cotton waste into landfill material.

In addition to the filter's impressive operating efficiency, the filter could possibly mean a savings to the cotton ginning industry. This savings cannot be calculated directly in dollars and cents. However, when projected in terms of air horsepower, the amount would be substantial—approximately 30 to 50 air horsepower for a gin plant processing 12 to 15 bales per hour. Air horsepower is the amount of energy required to move a known quantity of air against a known quantity of pressure.

Researchers now await the outcome of field tests on the filter's operational success and economic feasibility. □

n the air

Center: *Mr. McCaskill inspects vacuum nozzles that clean the experimental filter prior to operation. Cylindrical filter is positioned at the top of a two story high chamber (1272W1553–8).* ***Above:*** *Technician Durwood Hayes employs a high volume air sampler to determine dust concentrations being discharged from the experimental filter. The super-sensitive instrument records dust concentrations in micrograms per cubic meter of air (1272W1551–9).* ***Left:*** *Mr. McCaskill (right) and Mr. Hayes compare cotton trash samples after a ginning experiment with the new filter. Mr. Hayes holds "lint" fly collected by the filter—Mr. McCaskill holds trash comprised of burrs, sticks, and other solid material that settled to the bottom of the experimental chamber in the background (1272W1551–21).*

Mechanized harvesting for blueberries?

"MECHANIZE or perish." Economic circumstance has thrown this gauntlet at the feet of many U.S. fruit and vegetable industries and more is at stake than a point of honor.

ARS scientists and their colleagues at the North Carolina Agricultural Experiment Station, Raleigh, are studying ways to mechanize the blueberry industry.

"We must develop plant varieties, and production and processing techniques which form a totally integrated system of mechanization," explains plant physiologist Leaton J. Kushman.

At present, the industry is faced with cultural, production, and processing methods that were designed for a hand-harvesting system. Lack of labor is forcing the introduction of mechanical harvestors, bringing new problems.

For example, present blueberry varieties were selected for many economic traits, but not adaptability to mechanical harvesting. The mechanically compatible berry must be firm, resistant to bruising and decay, and easily separated from the bush.

Moreover, machines harvest berries at all stages of maturity, so the completely mechanized system of the future must incorporate a mechanical method of sorting.

Current harvesters bruise berries excessively when fruits fall or are thrown onto collecting belts and inclined surfaces. Tests in 1970 showed that firmness was reduced by almost a third, and the potential for developing decay greatly increased, by mechanical harvesting.

In a test of one technique to reduce this bruising, the scientists filled a collecting tank with protein or detergent foam alone, water, or water with a 6-inch blanket of foam floating on top. As a comparison, groups of berries were also carefully hand harvested directly into pulp pint containers.

Results showed that mechanically harvested blueberries that dropped into foam, water, or foam plus water were not bruised any more than those harvested by hand.

"Decay of berries harvested into foam was less than that of the berries harvested into water," reports Mr. Kushman. "So we believe that foam may have a good chance of being the answer to our problem of catching blueberries without bruising in future mechanical harvesting."

Foam also supplied a side benefit—berries sank through the foam, but leaves, bud scales, detached berry stems, and other light debris stayed in the upper 2 or 3 inches. This field cleaning feature can eliminate the need for cleaning of machine harvested berries in the packing house.

Mr. Kushman and his colleagues tested two sorting technques to combine precision with automation—one based on optical density, or blueness; the other based on the fact that berries softened by bruising are less resilient, or bouncy.

A blueberry light transmittance difference meter (LTDM), developed by ARS personnel, detects anthocyanin levels (blue pigmentation) of the berries. The more dense the pigmentation, the riper the berry. Measurements are made in light classes (LC), so for example, berries in LC 7 are overripe and likely to decay quickly, while an LC 3 berry might be half-red or green.

The tests point to light transmittancy as a promising method of sorting blueberries according to ripeness. Agricultural engineers at North Carolina State University, Raleigh, have developed a pilot mechanical sorter that incorporates the LTDM for inclusion in an experimental sorting, grading, and packing line.

Although ripening blueberries soften, they soften very little after turning blue. So while softness is not a good indicator of ripeness, it is a good indicator of bruising. As berries become soft from bruising their response to vibration decreases, so vibration can be used to sort out badly bruised fruits.

The test equipment is built around a variable frequency vibrator, with a V-shaped trough attached and angled upward. If berries are firm and bounce far enough when vibrated, they leave the trough and fall into a collecting container.

Firm berries bounce over a one-half-inch lip inclined at 30° from the horizontal at vibration frequencies at or below 230 cycles per second (c/s). Fruits that do not bounce out by the time 170 c/s is reached are very soft; some 80 percent of them decay during storage for 7 days at 70° F.

"Sub-systems of culture, harvesting, handling, sorting, and packaging of the future can be developed into an overall new system to eliminate the excessively bruised fruit associated with mechanical harvesters of today," predicts Mr. Kushman. □

In a darkened room, Mrs. Goulden grinds corn samples as she searches for the bright fluorescent glow that indicates the presence of aflatoxin. Mrs. Goulden wears special glasses that protect her eyes from prolonged exposure to ultraviolet light (1072X1414–4).

The tell–tale glow

As simple as hunting fireflies in the summer night, a new way to screen corn increases protection against health and financial hazards of aflatoxin.

If broken kernels fluoresce green-gold or bright, greenish-yellow—if they glow like fireflies under ultraviolet (UV) light—they contain materials associated with aflatoxin. This discovery by ARS scientists was developed as a method of identifying corn that may contain aflatoxin.

Corn buyers, from elevator operators to millers, are employing the method to determine whether corn should be analyzed chemically for aflatoxin level before they purchase or process the grain. Some buyers use hand-held UV lights to examine samples selected from corn lots. Others install UV lights over conveyor belts. This enables them to examine all corn coming into their plants.

The appearance of firefly glow in these examinations signals either outright rejection of the corn or extensive chemical analyses to determine aflatoxin levels and suitability of the grain for processing.

Before UV detection, to analyze or not was a question. Aflatoxin could be detected only by chemical analyses that take 15 to 30 minutes for each sample.

Some buyers, furthermore, have neither apparatus nor technicians to analyze for aflatoxin.

Aflatoxin is a chemical sometimes produced by the mold *Aspergillus flavus*. In susceptible test animals, the toxin has been found to be carcinogenic.

Aflatoxin is not visible under ordinary conditions, but materials associated with it fluoresce bright, greenish-yellow under long-wave (365 NM) UV light.

Fluorescence was developed as a detection method by organic chemist Odette L. Shotwell, technician Marion L. Goulden, and Clifford W. Hesseltine, chief of fermentation studies at the ARS Northern regional research laboratory, Peoria, Ill. They examined 34 corn samples under UV light, analyzed them, and found aflatoxin in all kernels and parts that glowed green-gold.

Some whole kernels did not glow but had yellow-green germ areas. When these kernels were opened, most of them glowed under UV light. Those that glowed contained aflatoxin. No aflatoxin was found in any materials—kernels, parts or opened kernels—that did not glow.

Dr. Shotwell concludes that aflatoxin can be present in a very small number of whole kernels that appear yellow-green but do not fluoresce until the material under the hull is exposed.

Under industrial handling conditions, however, corn lots that contain aflatoxin will almost always include broken kernels that glow bright, greenish-yellow under UV light. Kernels that contain aflatoxin break easily. □

Left: *Technician Wanda Jackson records ground corn samples prior to lab analysis for* Aspergillus flavus, *the mold responsible for aflatoxin (1072X1415–16).* ***Right:*** *Researchers conduct sophisticated analysis through thin layer chromatography to measure aflatoxin in corn samples that have previously been inspected under ultraviolet light. Here, Dr. Shotwell looks on as chemist Gail Shannon prepares extracts of corn samples for analysis (1072X1416–13).*

Spray vaccine stops distemper

It is a familiar tale how Rip Van Winkle slept 20 years while the world went on around him. Mink distemper spray vaccination had a similar experience, only this time it was the world that "slept."

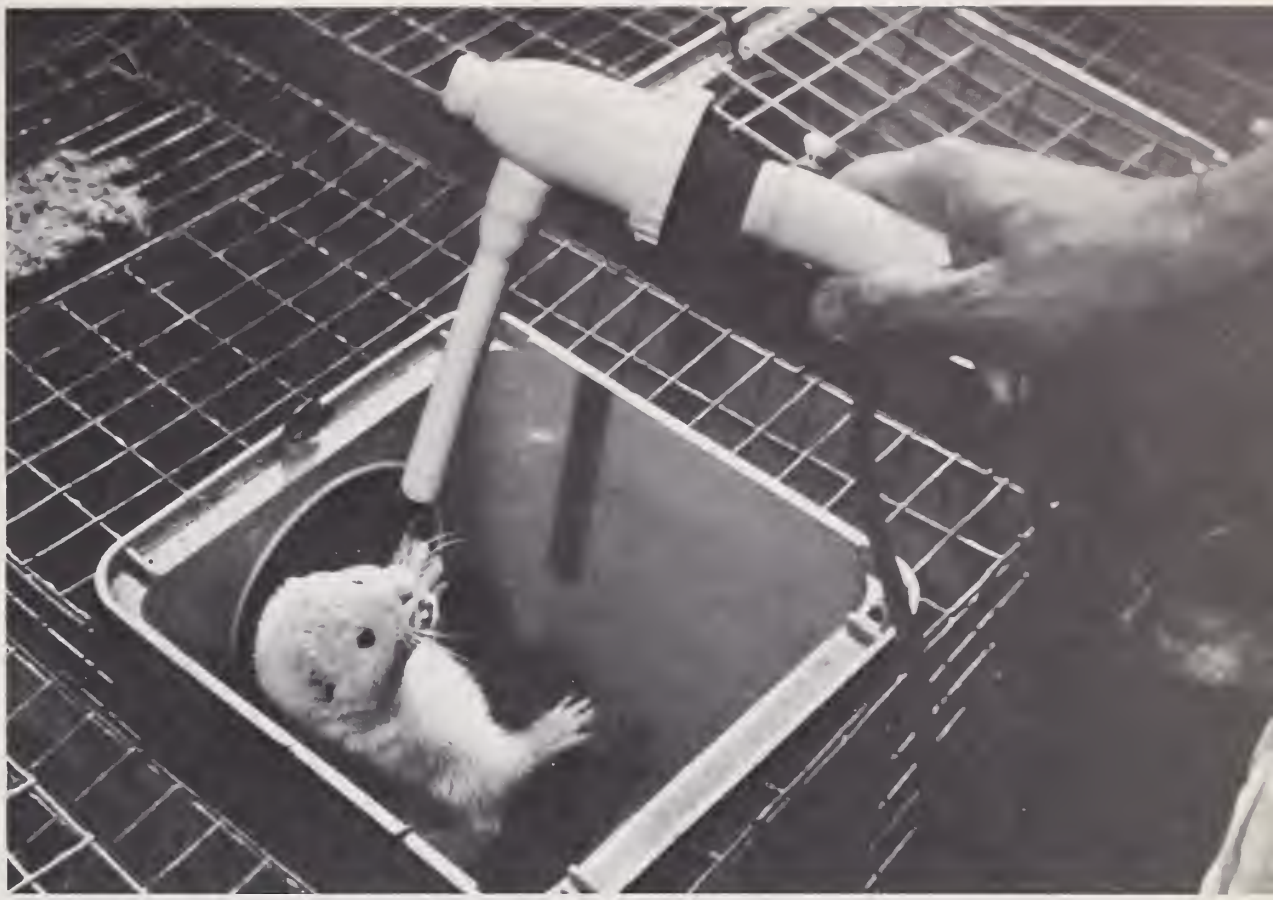
Distemper is a very serious disease in mink. Outbreaks can occur at any time of the year and almost all animals on a ranch become infected during an outbreak. Kits as young as 3 weeks may become infected, and losses in young mink run as high as 90 percent. Older mink average 30 to 40 percent casualties.

In 1954, ARS veterinarian John Gorham and his coworkers immunized mammals other than man for the first time with a live virus vaccine in an artificially created aerosol form. The researchers reasoned that in the case of mink distemper, the most logical and practical way to vaccinate was to use an attenuated live virus vaccine and administer it by the natural route its virulent counterpart infects the mink—through the air. This idea lay all but dormant for more than 16 years before large-scale vaccinations on commercial ranches became a reality.

The principle of airborne vaccination is well known. The Chinese in the fifth century first recorded the idea when they attempted to vaccinate against smallpox by taking a bamboo straw, dabbing an end into infected vesicle fluid, then blowing this fluid up the nose of a patient. It is not recorded how many patients successfully survived this treatment.

In the ARS experiments, Dr. Gorham's mink inhaled the vaccine as a fine spray or aerosol and became immunized. This vaccine-produced immunity proved as good as that produced by the older method of a syringe injection.

Spray-vaccinating offers several advantages, too. Neither mink nor handlers are stressed because the animals do not need to be handled during vaccination. Furthermore, since spray vaccination does not require mink restraint, it decreases the opportunity for virulent virus to spread when vaccinating during an outbreak.



Distemper vaccine is sprayed into nesting box of mink. In an actual treatment, a glass top would cover the nesting box to keep the fumes within (BN–40036).

Before mink could be spray-vaccinated on a large scale, the vaccine manufacturers had to develop a convenient apparatus that was not only portable, but also produced a sufficient cloud of vaccine to fill nest boxes long enough to allow the mink to be immunized. A United States company and a German company now produce such equipment. In 1972, ranchers spray-vaccinated about 2 million mink in Western Europe and North America. It is anticipated that the airborne vaccine will continue to gain widespread acceptance because of its labor and cost economy, now that the "world" has awakened to the vaccine's existence. □

These young mink are waiting to be vaccinated (BN–40037).

Marina v.N. Whitman named Atwater Lecturer

MARINA von Neumann Whitman, an authority on international economics and the first woman to be appointed to the President's three-member Council of Economic Advisors, will give the Fifth W. O. Atwater Memorial Lecture on June 25 in Atlantic City, N.J.

The lecture will be delivered before the 1973 annual meeting of the American Home Economics Association. Sponsored by ARS, the Atwater lecture honors Dr. Wilbur O. Atwater, USDA's first administrator of human nutrition research and the founder of modern nutrition as a science in the United States.

Problems in human nutrition are integrally related to economics, and Dr. Whitman's credentials in the international dimensions of the priorities in supply and demand provide eminent qualifications for the 1973 Atwater lecture.

Dr. Whitman is professor of economics at the University of Pittsburgh, Pittsburgh, Pa. She has served as a senior staff economist for the Council of Economic Advisors and was appointed to the seven-member national Price Commission when Phase II of the President's economic plan was initiated.

Dr. Whitman's approach to economics cannot be labeled Keynesian, free trader, monetarist, or any other broad term. Her economic philosophy is that of a pragmatist, rather than theorist. Her approach to economics is to identify specific problems and then explore solutions within the existing set of constraints.

Her major works include: *Economic Goals and Policy Instruments: Policies for Internal and External Balance; The U.S. Investment Guaranty Program and Private Foreign Investment; International and Interregional Payment Adjustment: A Synthetic View; Government Risk-Sharing in Foreign Investment.*

Speakers for the Atwater Memorial Lectures are chosen for their outstanding scientific contributions toward improving the ability of people or nations to realize their full potential.

Previous Atwater Memorial lecturers were: Dr. Artturi I. Virtanen, Nobel Prize-winning Finnish chemist; Dr. Albert Szent-Gyorgyi, Nobel Prize-winning biochemist; Dr. Philip Handler, President of the National Academy of Sciences; and Dr. Jean Mayer, international nutrition authority. □

Dr. Whitman (0473W301–28).

Rx for sugar-wall dates

TWO MILLION POUNDS of "sugar-wall" dates brought date growers $150,000 more profit last year because of the use of a simple spray treatment that corrects a defect in the maturation of the fruit.

The treatment raised the value of the dates from 5 cents per pound to 12½ cents per pound using existing processing equipment and an ingredient that cost only 2 cents per hundred pounds of dates.

Sugar-wall dates have crystallized sugar in the tissues giving the fruit either a hard texture similar to rock candy or a gritty, sandy texture—both undesirable traits. The sugar-wall condition can develop in the field, during storage, or during marketing and involves the proportion of sucrose to invert sugar and an enzyme—invertase.

Sucrose is a chemical compound composed of glucose and fructose—both natural fruit sugars. Invert sugar is a mixture of the same two sugars. Invertase breaks down sucrose, the compound, to invert sugar, the mixture. When these ingredients are in correct proportions, dates are moist and soft.

Fruit having the sugar-wall condition have too much sucrose in proportion to the invert sugar. They also have too little invertase activity which brings on the crystallization of sucrose molecules. Adverse growing conditions probably bring about the imbalance.

In solving the problem, chemists Dora Smolensky and Shin Hasegawa of Pasadena, Calif., sprayed some sugar-wall fruit with water and some with invertase. The water-sprayed fruit—similar to the usual hydration process of the industry—had a normal soft texture because the water dissolved the sucrose crystals.

After a short time, however, the gritty texture returned because of the recrystallization of the sucrose. That apparently is what happens commercially in cases where the sugar-wall condition occurs on market shelves after the dates have left the processor's.

When a small amount of invertase was added to the water, however, the sucrose crystals disappeared and the texture of the dates became soft and remained that way indefinitely. Analysis showed that because of the invertase, sufficient sucrose was hydrolized—broken down—to bring about a ratio of sucrose to invert sugar that was similar to normal high quality dates.

The ARS sugar-wall date treatment process has been adopted by the date industry. □

AGRISEARCH NOTES

Pollination by insects or wind?

HOW are chestnut trees pollinated? Insects, says horticulturist John W. McKay, although he doesn't rule out the wind entirely.

Dr. McKay, recently retired as leader of research on nut crops at the Agricultural Research Center, Beltsville, Md., offers convincing evidence in favor of insects:

The catkins (the male flowers of the chestnuts) produce large quantities of nectar, presumably to attract insects; several species of beetles visit the catkins in large numbers; chestnut pollen lumps together in sticky masses rather than in single grains as in wind-pollinated species; pollen grains are hard to trap on greased microscopic slides placed on the windward side of the trees; pollen is shed on the staminate portion of the mixed catkin at the same time the female flowers are receptive.

Finally, the production of chestnut honey is undeniable evidence that honey bees probably visit the flowers in large enough numbers to play a part in cross pollination. Dr. McKay points out, though, that the honey bees seem to prefer other nectars—chestnut honey is produced only when they are lacking. The honey, by the way, is black and very strong in flavor.

Dr. McKay believes that wind pollination may also occur under certain conditions.

Tocopherol unaffected by fumigation

FUMIGATION of stored wheat for periods up to 3 years does not affect the tocopherol (vitamin E) content of the grain, milling fractions, or the baked products.

The finding by ARS nutritionists provides much needed information on the effects of prolonged fumigation and storage. Wheat is normally kept for 2 or more years before use, and is routinely fumigated with pesticides to destroy insects.

Scientists of the Nutrition Institute, Beltsville, Md., found no significant differences in tocopherol in grain and milling fractions after eight treatments over a 3-year period with methyl bromide and ethylene dichloride, plus carbon tetrachloride and phosphine. Bread and rolls made with the resulting flour retained a surprisingly high level of the vitamin.

This finding is the latest in a continuing investigation of problems associated with pesticide retention in wheat.

Propanil-tolerant soybeans

SOME commercially grown soybean varieties appear more tolerant than others to the herbicidal effects of propanil. These varieties could reduce inadvertent losses in plantings near rice fields where propanil is used for weed control and winds may cause drifting.

In limited cooperative studies at the University of Arkansas Rice Branch Experiment Station at Stuttgart, ARS agronomist Roy J. Smith, Jr., and University agronomist Charles E. Caviness compared the effects of post-emergence treatments of propanil on 10 soybean varieties.

The 10 varieties included in the studies were Hill, Dare, York, Hood, Davis, Lee, Lee 68, Pickett, Semmes, and Bragg. Of these, Davis, Hood, and York were highly susceptible and were severely damaged while the remaining varieties were damaged only slightly to moderately.

The agronomists are currently evaluating the response of different soybean genotypes to propanil in an attempt to identify and develop highly resistant cultivars. Such resistance in new varieties would be especially beneficial because soybeans and rice are frequently rotated and grown in fields immediately adjacent to each other.

Beetle shuns WURLD wheat

THREE TYPES of WURLD wheat have built-in resistance to attack by the red flour beetle, an insect that often invades stored cereal products and grain.

WURLD wheat, a processed wheat developed by the ARS Western regional research laboratory, Berkeley, Calif., from the Gaines variety of wheat, is especially useful in meeting nutritional needs in tropical areas. Control of stored-product insects during storage and shipment is particularly difficult in these areas.

In studies at the U.S. Grain Marketing Research Center, Manhattan, Kans., entomologist Hobart P. Boles and technician Ralph L. Ernst evaluated the insect's attractiveness to three varieties of WURLD wheat. The product is a parboiled, lye-peeled, acid neutralized wheat dried for storage and distribution. Also included in the test were two forms of pearled wheat (light and heavy abrasion), unprocessed Gaines wheat, Gaines wheat flour, and bulgur.

Five samples of each product were placed in an enclosed chamber along with 800 adult red flour beetles. After

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7 days, the scientists removed and counted the insects in each sample, then transferred the samples to a rearing room for progeny development.

The WURLD wheats were less attractive to egg-laying beetles than the other products, and only a few progeny developed. In the free-choice test, 4.2, 6.4, and 8.5 percent of the adult insects invaded the three types of WURLD wheat. The number of progeny produced was only one-fourth to one-ninth as numerous as the adults that were introduced to these foods.

In contrast, progeny increase in relation to initial number of adults was 32 times for the pearled wheats, 10 times for Gaines wheat, 5 times for flour, and one-half for bulgur.

Zinc deficient diets impair learning

FEEDING a zinc-deficient diet to rats during lactation results in impaired learning in their offspring at 44 to 60 days of age.

This occurred in an experiment conducted at the new ARS Human Nutrition Laboratory at Grand Forks, N. Dak., by medical officer Harold H. Sandstead in cooperation with Paige M. Lokken, a University of North Dakota Ph. D. candidate in psychology; and University of North Dakota psychologist Edward S. Halas.

In this study, pregnant rats that had been fed nutritionally adequate diets were divided into three groups at the time of delivery. The first group was fed a zinc-deficient diet only; the second group was fed the same diet and in the same limited amount, but received zinc chloride in its drinking water; the third group was fed the zinc-deficient diet on a free-choice basis, and also received zinc chloride. The undernourished offspring of the first and second groups showed similar growth retardation.

All pups were weaned at 21 days of age and allowed 23 days for nutritional rehabilitation before behavioral studies were begun.

Young rats deprived of zinc during their infancy failed to learn to run through a maze as quickly as those that had been starved or adequately fed.

Dr. Sandstead, in one of his previous studies, found that zinc deficiency retards growth of suckling rats. Nucleic acid and protein synthesis in the brain and liver are also impaired.

The later experiment showed that though starved rats could learn the maze after rehabilitation, learning of the zinc-deficient rehabilitated rats was impaired. Zinc deficiency during the critical period for brain growth appears to produce injury which is less reversible than injury due to starvation.

When reporting research involving pesticides, this magazine does not imply that pesticide uses discussed have been registered. Registration is necessary before recommendation. Pesticides can be injurious to humans, domestic animals, desirable plants, and fish or other wildlife—if not handled or applied properly. Use all pesticides selectively and carefully.

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